Amendments to the Claims:

A clean version of the entire set of pending claims, including amendments to the claims, is submitted herewith per 37 CFR 1.121(c)(3). This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) In a wireless local area network (WLAN), a method for estimating an unknown multi-path channel and a noise variance in the presence of narrowband interference, said method comprising the steps of:

(a) receiving a time domain OFDM data packet;

(b) converting said time domain OFDM data packet to a frequency domain OFDM data packet;

(c) extracting a vector of training symbols having known transmitted values from said frequency domain OFDM data packet;

(d) using said training symbols to derive a simplified channel estimate that assumes no interference is present in the unknown multi-path channel, and

(e) estimating a noise variance of said narrowband interference using said simplified channel estimate at said step (d).

2. (Original) The method of Claim 1, wherein said WLAN is operated in accordance with the IEEE 802.11 standard.

3. (Cancel)

4. (Original) The method of Claim 1, wherein said step (d) of deriving said simplified channel estimate further comprises the steps of:

(1) recognizing a time-frequency relationship of a channel impulse response in the time domain to a channel impulse response in the frequency domain as:

$$\underline{H} = F\,\underline{h}$$

(2) using the recognized time-frequency relationship, $\underline{H} = F\,\underline{h}$, to derive a matrix solution of a received signal model in the frequency domain as:

$$\underline{r} = A\,(F\,\underline{h}\,) + \underline{n}$$

where

F is an N x Nc truncated Fourier matrix;

$\underline{h}$ is the channel impulse response in the time domain;

A is an N x N diagonal matrix comprised of said plurality of known transmitted data symbols; and

$\underline{n}$ is the noise vector;

(3) calculating a least squares estimate of the channel impulse response $\underline{H}$ as:

$$H_{LS} = F(G^H R_n^{-1} G)^{-1}\; G^H R_n^{-1}\; \underline{r}$$

(4) neglecting a noise correlation matrix term R_n^{-1} of the calculated least squares estimate of the channel impulse response $\underline{H}$ at step (3) to compute said simplified channel estimate in the frequency domain as:

$$H_{LS} = F(G^H G)^{-1}\; G^H\; \underline{r}$$

where F and A and G = AF are matrix values which are all known a-priori for long training sequences L1 and L2 at a receiving node in said WLAN.

5. (Original) The method of Claim 2, where said step (e) of estimating said noise variance further comprises the steps of:

computing an error vector e as:

$$\underline{e} = \underline{r} - A\hat{\underline{H}}_{LS} \text{ and}$$

calculating said noise variance estimate as:

$$\sigma_k^2 = \left|e_k\right|^2 .$$

6. (Original) In a wireless local area network (WLAN), a method for estimating

an unknown multi-path channel and a noise variance in the presence of narrowband interference, said method comprising the steps of:

(a) receiving a time domain OFMD data packet;

(b) converting said time domain OFDM data packet from said time domain to a frequency domain OFDM data packet;

(c) using training symbols from long training sequences L1 and L2 contained within said OFDM data packet to derive a simplified channel estimate in frequency as:

$$H_{LS} = F(G^H G)^{-1}\ G^H\ \underline{r}$$

where F and A and G = AF are matrix values which are all known a-priori for said long training sequences L1 and L2 at a receiving node in said WLAN;

(d) estimating a noise variance of said narrowband interference using said simplified channel estimate at said step (a), comprising the steps of:

(1) computing an error vector e as:

$\underline{e} = \underline{r} - A\underline{\hat{H}}_{LS}$; and

(2) calculating said noise variance estimate as:

$$\sigma_k^2 = |e_k|^2 \quad ;$$

(e) estimating a transmitted symbol as

$$a_{k,l} = r_{k,l} / \hat{H}_k$$

(f) slicing said estimated transmitted symbol $a_{k,l}$ to the nearest constellation point;

(g) estimating the noise variance at frequency k as:

$$\hat{\sigma}_{k,i}^2 = |r_{k,i} - \hat{H}_k \hat{a}_{k,i}|^2$$

(h) averaging the noise variance estimate over N OFDM data frames to obtain a more refined noise variance estimate as:

$$\hat{\sigma}_k^2 = \frac{1}{N_f + 1} \sum_{i=0}^{Nj} \hat{\sigma}_{k,i}^2 k = 1_n \ldots, N$$

7. (Original) The method of Claim 6, wherein said a more refined averaged noise variance estimate than that obtained at said step (d) is computed as:

$$\sigma_k^2 = W_L \sigma_{k,0}^2 + W_0/Nf \sum \sigma_{k,i}^2 \quad k = 1,2,\ldots,48$$

where $W_L + W_0 = 1$

$W_L =$ a weight corresponding to a long training sequence, e.g., L_1, L_2;

W_0 = a weight corresponding to one or more data frames.

8. (Original) The method of Claim 6, further comprising the steps of:

(i) decoding the sliced estimated transmitted symbol $a_{k,l;}$

(j) re-encoding the decoded symbol at said step (e); and

(k) repeating said steps (g) through (j) for N iterations to derive a more refined noise variance estimate than the one obtained at said step (d).

9. (Currently Amended) In a wireless local area network (WLAN), a system for estimating an unknown multi-path channel and a noise variance in the presence of narrowband interference, said system comprising:

means for receiving a time domain OFDM data packet;

means for converting said time domain OFDM data packet to a frequency domain OFDM data packet;

means for extracting a vector of training symbols having known transmitted values from said frequency domain OFDM data packet;

means for using said training symbols to derive a simplified channel estimate that assumes no interference in said unknown multi-path channel; and

means for estimating a noise variance of said narrowband interference using said simplified channel estimate at said step (d).

10. (Original) The system of Claim 9, wherein said WLAN is operated in accordance with the IEEE 802.11 standard.

11. (Cancel)

12. (Original) The system of Claim 9, wherein said means for using said training symbols to derive a simplified channel estimate, further comprises:

means for recognizing a time-frequency relationship of a channel impulse response in the time domain to a channel impulse response in the frequency domain as:

$$\underline{H} = F\,\underline{h}$$

means for using the recognized time-frequency relationship, $\underline{H} = F\,\underline{h}$, to derive a matrix solution of a received signal model in the frequency domain as:

$$\underline{r} = A\,(F\,\underline{h}) + \underline{n}$$

where

F is an N x Nc truncated Fourier matrix;

$\underline{h}$ is the channel impulse response in the time domain;

A is an N x N diagonal matrix comprised of said plurality of known transmitted data symbols; and

$\underline{n}$ is the noise vector;

means for calculating a least squares estimate of the channel impulse response $\underline{H}$ as:

$$H_{LS} = F(G^H R_n^{-1} G)^{-1}\ G^H R_n^{-1}\ \underline{r}$$

means for neglecting a noise correlation matrix term R_n^{-1} of the calculated least squares estimate of the channel impulse response $\underline{H}$ at step (3) to compute said simplified channel estimate in the frequency domain as:

$$H_{LS} = F(G^H G)^{-1}\ G^H\ \underline{r}$$

where F and A and G = AF are matrix values which are all known a-priori for long training sequences L1 and L2 at a receiving node in said WLAN.

13. (Original) The method of Claim 12, where said estimation of said noise

variance further comprises:

computing an error vector e as:

$$\underline{e} = \underline{r} - A\underline{\hat{H}}_{LS} \text{ ; and}$$

calculating said noise variance estimate as:

$$\sigma_k^2 = |e_k|^2 .$$

14. (Original) In a wireless local area network (WLAN), a system for estimating an unknown multi-path channel and a noise variance in the presence of narrowband interference, said system comprising:

mean for receiving a time domain OFMD data packet;

means for converting said time domain OFDM data packet from said time domain to a frequency domain OFDM data packet;

means for using training symbols from long training sequences L1 and L2 contained within said OFDM data packet to derive a simplified channel estimate in frequency as: $H_{LS} = F(G^H G)^{-1}\ G^H\ \underline{r}$,

where F and A and G = AF are matrix values which are all known a-priori for said long training sequences L1 and L2 at a receiving node in said WLAN;

means for estimating a noise variance of said narrowband interference using said simplified channel estimate at said step (a), comprising the steps of:

(1) computing an error vector e as:

$$e = \underline{r} - A\ H_{LS} \text{ ; and}$$

(2) calculating said noise variance estimate as:

$$\sigma_k^2 = |e_k|^2 \quad ;$$

means for estimating a transmitted symbol as:

$$a_{k,l} = r_{k,l} \ / \ \hat{H}_k$$

means for slicing said estimated transmitted symbol $a_{k,l}$ to the nearest constellation point;

means for estimating the noise variance at frequency k as:

$$\hat{\sigma}^2_{k,i} = \left| r_{k,i} - \hat{H}_k \hat{a}_{k,i} \right|^2$$

means for averaging the noise variance estimate over N OFDM data frames to obtain a more refined noise variance estimate as:

$$\hat{\sigma}^2_k = \frac{1}{N_f + 1} \sum_{i=0}^{Nf} \hat{\sigma}^2_{k,i} k = 1_n \ldots, N$$

15. (Previously Presented) The system of Claim 14, wherein said a more refined averaged noise variance estimate is computed as:

$\sigma_k^2 = W_L \sigma_{k,0}^2 + W_0/Nf \sum \sigma_{k,i}^2$ k = 1,2,...,48

where $W_L + W_0 = 1$

$W_L =$ a weight corresponding to a long training sequence, e.g., L_1, L_2;

W_0 = a weight corresponding to one or more data frames.

16. (Original) The system of Claim 14, further comprising:

means for decoding the sliced estimated transmitted symbol $a_{k,I;}$

means or re-encoding the decoded symbol at said step (e); and

means for repeating said steps (g) through (j) for N iterations to derive a more refined noise variance estimate than the one obtained at said step (d).

17. (Previously Presented) The method of claim 1, wherein using the training symbols to derive a simplified channel estimate comprises calculating a channel impulse response frequency matrix for each frequency bin in the frequency domain OFDM data packet assuming that all noise in the channel is white Gaussian noise with zero mean and variance.

18. (Previously Presented) The system of claim 9, wherein the means for using the training symbols to derive a simplified channel estimate calculates a channel impulse response frequency matrix for each frequency bin in the frequency

domain OFDM data packet assuming that all noise in the channel is white Gaussian noise with zero mean and variance.